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Sir.

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For. **Method and System for Touch Screen Keyboard and Display Space Sharing**

Enclosed are·

X Patent Specification and Declaration

X **6** sheets of drawing(s).

X An assignment of the invention to International Business Machines Corporation (includes Recordation Form Cover Sheet).

___ A certified copy of a __ application.

X Information Disclosure Statement, PTO 1449 and copies of references

The filing fee has been calculated as shown below:

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Basic Fee				$790
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METHOD AND SYSTEM FOR TOUCH SCREEN KEYBOARD AND DISPLAY SPACE SHARING

BACKGROUND OF THE INVENTION

1. Technical Field:

The present invention relates to improved information-retrieval methods and systems. In particular, the present invention relates to improved information-retrieval methods and systems utilized in association with graphical user interface devices. More particularly, the present invention relates to portable computers. Still more particularly, the present invention relates to touch screen display units. Finally, the present invention relates to methods and systems for saving space in touch screen keyboard and display devices.

2. Description of the Related Art:

Touch screen technology is increasingly being utilized in all facets of data-processing applications. A touch screen is a display device that allows users to interact with a computer system by touching a particular area on the surface of the screen. Touch screen technology can be implemented by any of a number of sensing techniques. For example, touch screen technology can be implemented by detecting disturbances on a screen utilizing the fingers of a user. Typically, this disturbance is detected through the interruption or detection of heat on the screen.

Touch screen technology is increasingly being implemented in association with portable computers, such as so-called "laptop" and "notebook" computers, and small calculator-size mini-portable computers. As devices become increasingly portable in nature, the need for smaller and more compact

devices increases. Thus, a problem encountered in decreasing the size of portable computers is the need to save space.

5　　　For example, in most portable computers, two distinct spaces are required. First, a panel for the display itself and second, a section for the computer keyboard. These two requirements add weight, cost and size to the design of a laptop computer. Touch screen technology offers an alternative approach around such spatial restrictions. However, to date, touch screen technology usually includes

10　　keyboards that occupy distinct areas away from the display, or when combined with the display, are uncomfortable and awkward for the user to access. An example of a touch screen display can be found in U.S. Patent No. 5,581,243, "Method and Apparatus for Displaying Simulated Keyboards on Touch-

15　　Sensitive Dislays," by Ouellette et al. Such touch screen keyboards, while advancing the art, do not permit users to access touch screen keyboards in an efficient and versatile manner. The challenge lies in crafting a portable computer in which compactness and vesatility is improved by incorporating

20　　touch screen keyboards that are easy to access and use.

Based on the foregoing, it can be appreciated that a need exists to reduce the size of portable computers, which in turn saves on the parts necessary to construct such computers. As a result of reducing the size of the touch screen, portable

25　　computers which utilize touch screen technology may be constructed with greater compactness and efficiency. It is believed that the disclosure provided addresses and solves these problems in a unique and previously unknown manner.

SUMMARY OF THE INVENTION

It is therefore an object of the invention to provide an improved information-retrieval method and system.

It is another object of the invention to provide improved information-retrieval methods and systems utilized in association with graphical user interface devices.

It is yet another object of the invention to provide an improved portable computer system.

It is still another object of the invention to provide an improved touch screen display unit which may be utilized in association with information-retrieval systems.

It is another object of the invention to provide a method and system for promoting increased compactness in portable computer systems by reducing the space consumed by display screens and user input devices utilized in such computer systems.

The above and other objects are achieved as is now described. A method and system are disclosed in a portable computer having a display screen for increasing portable computer compactness. Data is displayed initially within the display screen. The display screen is then partitioned into a touch-sensitive input area and a display area, wherein data input at the touch-sensitive input area may be simultaneously displayed in the display area, in response to a particular user input. A test is performed to detect if a user's hands are positioned at the touch-sensitive input area. A touch-sensitive pad is thereafter graphically displayed at the touch-sensitive input area within the display screen, in response to detecting a user's hands positioned at the touch-

sensitive area, wherein a user may enter data that may be simultaneously displayed in the display area.

An additional test may then be performed to detect if the user's hands are no longer positioned at the touch-sensitive input area. The touch-sensitive pad is subsequently concealed from view, in response to detecting if the user's hands are no longer positioned at the touch-sensitive input area. The touch-sensitive pad graphically displayed at the touch-sensitive input area within the display screen may be composed of a touch-sensitive keyboard. Thus, when the user places his or her hands at the touch-sensitive area, the transparent keyboard appears at the touch-sensitive area within the display screen. When the user removes his or hands from the touch-sensitive input area, the transparent keyboard vanishes. The keyboard itself can be an ergonomic keyboard.

In addition, physical characteristics associated with the user can be analyzed, while the user is entering a particular sequence of data utilizing the touch-sensitive keyboard, in order to customize the keyboard according a user's physical characteristics and personal preferences. In response to analyzing such physical characteristics, the touch-sensitive keyboard is configured so that the sensitivity of the touch-sensitive keyboard may be raised or lowered according to the physical characteristics associated with the user.

BRIEF DESCRIPTION OF THE DRAWINGS

The novel features believed characteristic of the invention are set forth in the appended claims. The invention itself, however, as well as a preferred mode of use, further objects, and advantages thereof, will best be understood by reference to the following detailed description of an illustrative embodiment when read in conjunction with the accompanying drawings, wherein:

FIG. 1 illustrates a pictorial representation of a computer system, which may be utilized to implement a preferred embodiment of the present invention;

FIG. 2 depicts a representative hardware environment of a computer system, which may be utilized to implement a preferred embodiment of the present invention;

FIG. 3 illustrates a pictorial representation of a prior art touch screen display;

FIG. 4 depicts a pictorial representation of a document displayed within a graphical user interface window in a normal display mode, in accordance with a preferred embodiment of the present invention;

FIG. 5 illustrates a pictorial representation of a document displayed within a graphical user interface window in a mouse mode, in accordance with a preferred embodiment of the present invention;

FIG. 6 depicts a pictorial representation of graphical user interface window displayed in a keyboard mode, in accordance with a preferred embodiment of the present invention;

FIG. 7 illustrates a pictorial representation of graphical user interface window displayed in a keyboard mode following manipulation of a document by a graphical keyboard, in accordance with a preferred embodiment of the present invention; and

FIG. 8 depicts a high-level flowchart of operations illustrating a method for keyboard and display space saving in a touch screen display, in accordance with a preferred embodiment of the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

With reference now to the figures and in particular with reference to **FIG. 1**, there is depicted a pictorial representation of a computer system, which may be utilized to implement a preferred embodiment of the present invention. A computer system **20** is depicted that includes a system unit **21**, speakers **46** and a video display **23**. Computer system **20** includes a graphical user interface that resides within a machine-readable media to direct the operation of computer system **20**. Those skilled in the art will appreciate that the method and system of the present invention apply equally to any computer system, regardless of whether the computer system is a complicated multi-user computing apparatus or a single-user workstation. A touch screen display is utilized in association with computer system **20** to convey visual data and receive input from a user. Such a touch screen may also utilize or incorporate graphical user interface features.

FIG. 2 depicts a representative hardware environment of computer system **20** of **FIG. 1**, which may be utilized to implement a preferred embodiment of the present invention. System unit **21** of **FIG. 1** includes a Central Processing Unit ("CPU") **31**, such as a conventional microprocessor, and a number of other units interconnected via system bus **32**. Computer system **20** includes random-access memory ("RAM") **34**, read-only memory ("ROM") **36**, display adapter **37** for connecting system bus **32** to video display **23**, and I/O adapter **39** for connecting peripheral devices such as disk and tape drives **33** to system bus **32**.

Disk and tape drives **33** are electro-mechanical devices that read from and write to disks. The main components of a disk drive include a spindle on which the disk is mounted, a drive motor that spins the disk when the drive is in

operation, one or more read/write heads that perform the actual reading and writing, a second motor that positions the read/write heads over the disk, and controller circuitry that synchronizes read/write activities and transfers information to and from computer system **20**. A disk itself is typically a round, flat piece of flexible plastic (e.g., floppy disk) or inflexible metal (e.g. hard disk) coated with a magnetic material that can be electrically influenced to hold information recorded in digital (i.e., binary) form. A disk is, in most computers, the primary method for storing data on a permanent or semipermanent basis. Because the magnetic coating of the disk must be protected from damage and contamination, a floppy (e.g., 5.25 inch) disk or micro-floppy (e.g., 3.5 inch) disk is encased in a protective plastic jacket. A hard disk, which is very finely machined, is typically enclosed in a rigid case and can be exposed only in a dust free environment.

Video display **23** is the visual output of computer system **20**. Video display **23** can be, for example, a CRT-based video display well-known in the art of computer hardware. "CRT" is an acronym for cathode-ray tube. Video display **23** can also be implemented as an LCD-based or a gas plasma-based flat-panel display. "LCD" is an acronym for liquid crystal display. Those skilled in the art can thus appreciate that computer system **20** may be modified to be implemented as a notebook-based computer. Computer system **20** may further include user interface adapter **40** for connecting keyboard **26**, mouse **28**, speaker **46** (i.e., analogous to speakers **46** of **FIG. 1**), microphone **48**, and/or other user interface devices to system bus **32**. Communications adapter **49** connects computer system **20** to a computer network. Although computer system **20** is shown to contain only a single CPU and a single system bus, it should be understood that the present invention applies equally to computer systems that posses multiple CPUs and to

computer systems that include multiple buses that each perform different functions in different ways.

Computer system **20** also includes a graphical user interface that resides within a machine-readable media to direct the operation of computer system **20**. Any suitable machine-readable media may retain the graphical user interface, such as RAM **34**, ROM **36**, a magnetic diskette, magnetic tape, or optical disk (the last three being located in disk and tape drives **33**). Any suitable operating system and associated graphical user interface (e.g., Microsoft Windows) may direct CPU **31**. For example, the AIX operating system and AIXwindows windowing system (i.e., graphical user interface) can direct CPU **31**. The AIX operating system is IBM's implementation of the UNIX operating system. UNIX is a trademark of UNIX Systems Laboratories, Inc. Other technologies can also be utilized in association with CPU **31**, such as touch-screen technology or human voice control. Those skilled in the art will appreciate that the hardware depicted in **FIG. 2** may vary for specific applications. For example, other peripheral devices such as optical disk media, audio adapters, or chip-programming devices, such as PAL or EPROM programming devices well-known in the art of computer hardware, and the like may be utilized in addition to or in place of the hardware already depicted.

Main memory **50** is connected to system bus **32**, and includes a control program **51** that resides within main memory **50** and contains instructions that when executed on CPU **31**, carry out the operations depicted in the logic flow chart described herein. The computer program product can also be referred to as a program product. It is important that, while the present invention has been (and will continue to be) described in the context of a fully functional computer system, those skilled in the art will appreciate that the

present invention is capable of being distributed as a program product in a variety of forms, and that the present invention applies equally regardless of the particular type of signal-bearing media utilized to actually carry out the distribution.

Examples of signal-bearing media include: recordable-type media, such as floppy disks, hard disk drives and CD ROMs, and transmission-type media such as digital and analog communication links. Examples of transmission-type media include devices such as modems. A modem is a type of communications device that enables a computer to transmit information over a standard telephone line. Because a computer is digital (i.e., works with discrete electrical signals representative of binary 1 and binary 0) and a telephone line is analog (i.e., carries a signal that can have any of a large number of variations), modems can be utilized to convert digital to analog and vice-versa. The term "media" as utilized herein is a collective word for the physical material such as paper, disk, CD-ROM, tape and so forth, utilized for storing computer-based information.

FIG. 3 illustrates a pictorial representation of a prior art touch screen display **60**. Touch screen display **60** is a specialized computer display screen which is designed to recognize the location of a touch on the surface of the screen (i.e. touch screen **63**). By touching the screen, the user can make a selection or move a cursor. Although not depicted in **FIG. 3**, those skilled in the art will appreciate that touch screen display **60** may be implemented on a portable computer display, such as the compact computer system illustrated in **FIG. 1**. Display **23** of **FIG. 1** may be implemented as a compact version of touch screen display **60** of **FIG. 3**.

Touch screen **63** can be composed of one or more sensing line grids, which determine the location of a touch by matching vertical and horizontal contacts. In addition, touch screen display may include an electrically charged surface and sensors around the outer edge of the screen to detect the amount of electrical disruption and pinpoint exactly where contact has been made. Touch screen display **60** may also include infrared light-emitting diodes (LEDs) around the outer edges of the screen (i.e., touch screen **63**), which together with additional sensors, create an invisible infrared grid, which the user's finger interrupts, in front of the screen.

Thus, according to the diagram depicted in **FIG. 3**, a user's hand **64** (i.e., particularly a user's fingers) may touch keys **62**, which are graphically displayed within touch screen display **60**. By touching a particular key, such as a key **62**, a series of data-processing operations associated with that particular key, may be initiated. Touch screen **63** of touch screen **60** is thus a display device that allows the user to interact with a computer system, such as computer system **20** of **FIG. 1** and **FIG. 2**, by touching a particular area on the screen.

A preferred embodiment of the present invention calls for a merging of the display area and a keyboard input area utilizing touch screen technology. When a user places his or her hands over the bottom half or two-thirds of the touch screen display, a translucent keyboard appears under his or her fingers. The current text or graphics displayed on the touch screen display will still be seen through the keyboard. However, when the user touches the graphically displayed keyboard "keys," keyboard input is reflected onto the screen immediately behind the graphically displayed keyboard. The keyboard is in essence a "phantom" keyboard, in that it appears and vanishes depending upon the presence of a

particular user input, such as the placement of a user's hands near a designated area on the touch screen. When graphically displayed on the screen, the keyboard is transparent, such that any data (e.g., words or paragraphs) that were displayed prior to the display of the transparent keyboard are visible "below" the keyboard.

In **FIG. 4**, **FIG 5**, and **FIG. 6**, and **FIG. 7** similar parts are indicated by identical reference numerals. **FIG. 4** depicts a pictorial representation of a document **82** displayed within a graphical user interface window **83** in a normal display mode, in accordance with a preferred embodiment of the present invention. The graphical user interface, as described previously, is a type of computer interface composed of a visual metaphor reflecting a real-world scene, often of a desktop. Within this scene are icons, representing actual objects, that the user may access and manipulate with a pointing device. Window **80** includes specific icons, which when manipulated by a user via a pointing device, allow a user to scroll up or down through document **82**. For example, down-arrow **96** allows a user to scroll downward, while up-arrow **94** allows a user to scroll upward through document **82**.

Down-arrow **96**, up-arrow **94** and slider **90** are positioned within scroll bar **92**. Scroll bar **92** is a graphical device that can be utilized to change a user's viewpoint of a list or data file. The user alters the view by sliding slider **90** up or down in the scroll area or by pressing one of the scroll arrows (i.e., down-arrow **96** or up-arrow **94**), which causes the view to scroll up or down in the window area adjacent the scroll bar. Window **83** additionally includes an area in which "M," "K," and "D" graphical buttons are located (i.e., "M" button **84**, "K" button **86**, and "D" button **88**). As described herein, "M" button **84** initiates a "mouse" mode, "K" button **86** initiates a "keyboard" mode, and "D" button **88** initiates a

normal display mode.   As indicated by the shaded "D" button
88, window **83** of **FIG. 4** depicts a normal display mode.

FIG. 5 illustrates a pictorial representation of document
82 displayed within graphical user interface window **83** in a

5   mouse mode, in accordance with a preferred embodiment of the
present invention.   Cursor **120** indicates a position within
document **82** from which a user might begin editing document **82**.
The document displayed within window **83** of **FIG. 5** is in a
"mouse mode, as indicated by shaded "M" button **84**.   The user

10   may manipulate document **82** utilizing a pointing device such as
a mouse.   Because the graphical user interface depicted in
FIG. 5 is implemented on a touch screen device, the user
merely places an index finger at mouse pointer **89** and moves
the mouse pointer toward the desired area.   Movement of the

15   mouse pointer is indicated in **FIG. 5** by curved lines **85**.
Circle **87** indicates the actual position of a user's finger on
the touch screen as the mouse pointer **89** is moved toward
cursor **120**.

FIG. 6 depicts a pictorial representation of graphical

20   user interface window **83** displayed in a keyboard mode, in
accordance with a preferred embodiment of the present
invention.   **FIG. 7** illustrates a pictorial representation of
graphical user interface window **83** displayed in a keyboard
mode following manipulation of document **82** by keyboard **110**, in

25   accordance with a preferred embodiment of the present
invention.   The keyboard mode is indicated by shaded "K"
button **86**.   When the graphical user interface window functions
in a keyboard mode, a user can place his or her hands over the
bottom half or two-thirds of display screen **80**.   Touch screen

30   technology detects the presence of the user's hands in these
areas.

Thus, when the user's hands are detected, a translucent or transparent keyboard **110** appears beneath the user's fingers on display screen **80**. Although not depicted specifically in **FIG. 6** and **FIG. 7**, current text, graphics or other documents will still be visible through the keyboard. When the user touches the "keys" displayed on display screen **83**, keyboard input is reflected onto the screen beneath transparent keyboard **110**. Those skilled in the art will appreciate that the circles depicted on transparent keyboard **110** indicated where a user's hands can be positioned to manipulate the keyboard. For example, a user's left hand fingers may be positioned respectively on the "A", "S", "D," "F" and space bar keys, while a user's right hand fingers may be positioned at the ";", "L", "K", "J" and space bar keys. The larger circles depicted in **FIG. 6** and **FIG. 7** indicate the position of the user's palms. If the user takes his or hands away from the touchscreen surface, the projected keyboard fads away. If a user's hand is then detected at the touchscreen, the keyboard reappears. This hide and display action continues until an option other than a "K" mode is selected.

Because the user must also be able to see the actions associated with his or her typing, a smaller "active" window **100**, is displayed to indicate the actual typing taking place. Window **100** includes a scroll bar **102** having a slider **106**, an up-arrow **108**, and a down-arrow **104** which functions similar to the scroll bar, slider and arrows associated with window **83**. Of course, as indicated previously, the actions performed via keyboard input are simultaneously displayed in the actual text that resides "beneath" keyboard **110**, as well as in window **100**. Window **100** thus includes a document **101**, which is in essence, a smaller version of document **82**.

If the user has the need to manipulate document **82** with a mouse, the user simply moves his or her hands away from the

keyboard, and touches "M" button **84**. A mouse pointer (e.g., mouse pointer **89**) subsequently appears and transparent keyboard **110** vanishes from sight. The user can then manipulate the mouse or other pointing device for object

5   selection or drag. When the user finishes this task, the user then touches "K" button **86**, which places the display screen back into the keyboard mode. When the user's hands approach display screen **80** (i.e., when the presence of the user's hands at the display screen are detected), the keyboard materializes

10   on the display screen beneath his or her fingers. Various levels of translucency can be specified by the user.

Thus, transparent keyboard **110** is that part of computer system **20** of **FIG. 1** that resembles a typewriter keyboard and which enables a user to control particular aspects of the

15   computer. Transparent keyboard **110** can include a standard set of printable characters presented in a QWERTY pattern typical of most typewriters. In addition, transparent keyboard **110** may include a calculator-like numeric keypad at one side and additional specialized keys. Some of these keys, such as the

20   "Control," "Alt," and "Shift" keys may be utilized to change the meaning of another key. Other special keys and combinations of keys can be utilized to control program operations or to move either displayed text or cursors.

FIG. 8 depicts a high-level flowchart of operations **140**

25   illustrating a method for keyboard and display space saving in a touch screen display, in accordance with a preferred embodiment of the present invention. It can be appreciated by those skilled in the art that **FIG. 8** presents a self-consistent sequence of steps leading to a desired result. The

30   steps are those requiring physical manipulation of physical quantities. Usually, although not necessarily, these quantities take the form of electrical or magnetic signals capable of being stored, transferred, combined, compared, and

otherwise manipulated. It has proven convenient at times by those skilled in the art, to refer to these signals as bits, values, elements, symbols, characters, terms, numbers, or the like. It should be borne in mind, however, that all of these and similar terms are to be associated with the appropriate physical quantities and are merely convenient labels applied to these quantities.

Further, the manipulations performed are often referred to in terms, such as "displaying" or "partitioning," which are commonly associated with mental operations performed by a human operator. No such capability of a human operator is necessary or desirable in most cases in any of the operations described herein which form part of the present invention; the operations are machine operations. Useful machines for performing operations of a preferred embodiment of the present invention include data-processing systems such as general purpose digital computers or other similar devices. In all cases the distinction between the method operations in operating a computer and the method of computation itself should be borne in mind. The present invention relates to method steps for operating a computer, such as the computer system depicted in **FIG. 1** and **FIG. 2**, and associated touch screen displays such as the touch screen display depicted in **FIG. 3**, in processing electrical or other (e.g. mechanical, chemical) physical signals to generate other desired physical signals.

Thus, as illustrated at block **142**, the process depicted in **FIG. 8**, is initiated, as indicated by the phrase "START." As described at block **144**, a touch screen display is designated, such as the touch screen display depicted in **FIG. 3** herein. A document that the user wishes to manipulate or edit may be displayed on the touch screen display (i.e., also referred to simply as a "display screen"). Those skilled in

the art will of course appreciate that the touch screen display designated, according to block **144**, may be implemented in "laptop" or "notebook" form as a flat screen placed horizontally on a flat surface from which a user may

5 manipulate the "phantom" keyboard that appears as a result of the operations described herein. As illustrated at block **146**, the user places his or her hands at the touch screen display. In a preferred embodiment of the present invention, the user's hands may be placed over the bottom half or two-thirds of the

10 touch screen display.

As indicated at block **148**, a test is performed to determine if the user's hands are located over the appropriate area of the touch screen display (e.g., at the bottom half or two-thirds of the display). A detection device is utilized to

15 detect the user's hands. Such a device may detect the user's hands via sound or heat detection, although such detection techniques are not necessary features of the present invention. Assuming that the user's hands are detected, then as described at block **150**, partitioning of the touch screen

20 display is initiated. Thereafter, as described at block **152**, the actual partitioning occurs wherein the display screen is partitioned into a touch-sensitive input area and a display area, wherein data input at the touch-sensitive input area may be simultaneously displayed in the display area, in response

25 to a particular user input (e.g., "typing" on a graphically displayed touch sensitive keyboard), such that the partitioning of the display screen promotes increased portable computer compactness by decreasing user input and display areas.

30 As illustrated at block **154**, a transparent keyboard is thus displayed within the touch-sensitive input area. The transparent or translucent keyboard "appears" under the user's fingers. The current text or graphics can still be seen

"through" the keyboard, however when the user touches the
keyboard graphical "keys" displayed on the display screen, the
keyboard input is reflected onto the screen area "beneath" the
keyboard." Because it is necessary for the user to be able to
5   view the actions associated with his or typing, the top
portion of the display screen is reserved for a "mini-window,"
as indicated at block **156**. The mini-window displays a portion
of the document that the user wishes to edit. Those skilled
in the art will appreciate that the display of the mini-window
10   does not in fact constitute a separate output device. The
display and the keyboard constitute the same physical device
(i.e., the touchscreen). Any changes made to the mini-screen
are also made to the text "hidden" or "obscured" by the
displayed transparent keyboard.

15   As indicated at block **164**, a test is performed to
determine whether to discontinue partitioning and return the
display screen to a "normal" or non-partitioned mode or to
continue operating under the partition (i.e., "keyboard
mode"). If the display screen continues under a "keyboard
20   mode," then the processing beginning, as described at block
154, is repeated. If the user desires to return to a "display
mode," in which the mini-window and the keyboard vanish and
the text is simply displayed on the screen, then the operation
illustrated at block **166** is processed. The process may
25   subsequently terminate, as indicated by the word "END," as
described at block **168**.

               As illustrated at block **148**, if the user's hands are not
detected at the touch screen display, then a test is
performed, as indicated at block **149**, to determine whether or
30   not a "D" or an "M" was chosen by the user. Choosing a "D"
initiates a the "display mode" described at block **166**.
Choosing "M" initiates a "mouse mode," as described at block
151, in which the user can manipulate the text displayed on

the screen with a mouse or other similar pointing device. Thus, if the user wishes to manipulate the document with a mouse, the user may operate the display screen in a so-called "mouse mode" by removing his or her hands from the keyboard and touching a graphically displayed screen button with the word "MOUSE" or simply the letter "M." Once in the "mouse mode," as indicated at block **151**, a mouse pointer appears and the translucent keyboard vanishes.

The user may manipulate the mouse for object selection or dragging of object data. As subsequently indicated at block **153**, a test is performed to determine whether or not to end the "mouse mode" or continue. If the user desires to continue operating under the "mouse mode," then as depicted at block **151** the process simply continues. If the user discontinues operation of the display under the "mouse," then as illustrated at block **155**, a test is performed to determine whether or not to initiate a "keyboard mode" by choosing the letter "K" or the "display mode" by choosing the letter "D." The letters "K" "D" and "M" and resulting associated functions are illustrated in **FIG. 4**, **FIG. 5**, **FIG. 6,** and **FIG. 7** herein. If a "keyboard mode" is manually chosen by the user, then the process, as illustrated beginning at block **150**, is repeated. If the "display mode" is manually chosen by the user, then the operation, as described at block **166**, is processed.

Although not specifically illustrated in flow diagram **140** of **FIG. 8**, those skilled in the art will appreciate that the displayed touch-screen keyboard itself can be composed of an ergonomic keyboard, customized to be split apart for usability and ergonomics. Although the displayed transparent keyboard is in essence a "virtual" keyboard, those skilled in the art will appreciate that this "virtual" keyboard can be "cut" and "pasted" together in varying positions and rotations to create an ergonomic keyboard. For example, one "half" of the

keyboard can reside on the touchscreen in a different X,Y coordinate than the remaining half of the keyboard. The "half" portion of the keyboard can also be selected by a user to encompass more less input keys than an ordinary QWERTY keyboard. Of course, such modifications will depend upon a particular implementation of a preferred embodiment of the present invention.

The keyboard can also be customized according to physical characteristics associated with a particular user. If two or more people share they keyboard/screen, the keyboard can be customized according to width of their respective fingers, their personal preferences, and a "heat sensitivity" index associated with their hands. In order to accomplish this particular task, several basic steps must be performed. First, physical characteristics associated with a particular user must be analyzed while the user is entering a particular sequence of data utilizing the touch-sensitive keyboard. Second, in response to analyzing the physical characteristics associated with that particular user, the touch-sensitive keyboard must be configured such that the sensitivity of the touch-sensitive keyboard may be raised or lowered according to the physical characteristics associated with the user.

Customizing the transparent touch-screen keyboard according to physical characteristics associated with a particular user can be accomplished via a touch screen configuration routine. Such a touch screen configuration routine, when processed, prompts a user to type out a series of sentences utilizing the displayed transparent touch-screen keyboard. The configuration routine must be designated ahead of time by the user. The user must designate parameters that the configuration routine will utilize in subsequent data-processing operations. For example, a user can designate particular heat/sound identification criteria according to a

particular portion of the displayed transparent touch-screen keyboard.

As the user types out the sentences via the displayed transparent touch-screen keyboard, an analysis of the user's "fingerprint heat/sound" signature is taken. Once the configuration routine is designated, approval must be given by the user to implement the actual configuration routine. A test can then be performed to determine whether or not user approval for running the configuration routine has been given. If approval by the user is not given, the process simply terminates. However, if approval by the user is given, then the configuration routine is processed within the parameters set earlier by the user. Thereafter, the physical characteristics of the user are analyzed while the user types out the set of sentences via the displayed transparent touch-screen keyboard during running of the configuration routine. Appropriate sensitivities are determined.

In response to analyzing these physical characteristics, the displayed transparent touch-screen keyboard is calibrated according to the identified sensitivities. For example, the heat required to depress a keyboard key far away is registered. On the other hand, the heat needed to depress a nearby key is also registered such that the displayed transparent touch-screen keyboard does not register an inadvertent keystroke due to a user's fingers close proximity to the displayed transparent touch-screen keyboard. Of course, those skilled in the art will appreciate that other sensitivities may also be identified. For example, sound waves associated with a user's fingers may also be utilized to calibrate the displayed transparent touch-screen keyboard.

While the invention has been particularly shown as described with reference to a preferred embodiment, it will be

understood by those skilled in the art that various changes in form and detail may be made therein without departing from the spirit and scope of the invention. For example, while in a "display mode" or "D" mode, an external computer keyboard, may

5   be attached to the computer system (i.e., computer system **20**) and utilized to manipulate displayed text and graphical object objects. A pointing device, such as an external mouse, may also be attached to the computer system, and utilized in association with the computer keyboard during the "display

10   mode," which differs from the "M" or "mouse" mode in which the graphically displayed touch screen keyboard vanishes and the user manipulates displayed text and objects solely with a mouse or other pointing device.

       It is therefore contemplated that such modifications can

15   be made without departing from the spirit or scope of the present invention as defined in the appended claims.

CLAIMS:

What is claimed is:

1   1.   A method in a portable computer having a display screen
2   for increasing portable computer compactness, said method
3   comprising the steps of:

4   displaying data within said display screen; and

5   partitioning said display screen into a touch-sensitive
6   input area and a display area, wherein data input at said
7   touch-sensitive input area may be simultaneously displayed in
8   said display area, in response to a particular user input;

9   detecting if a user's hands are positioned at said touch-
10   sensitive input area; and

11   graphically displaying a touch-sensitive pad at said
12   touch-sensitive input area within said display screen, in
13   response to detecting a user's hands positioned at said touch-
14   sensitive area, wherein a user may enter data that may be
15   simultaneously displayed in said display area.

1   2.   The method of claim 1 further comprising the steps of:

2   detecting if said user's hands are no longer positioned
3   at said touch-sensitive input area; and

4   concealing said touch-sensitive pad from view, in
5   response to detecting if said user's hands are no longer
6   positioned at said touch-sensitive input area.

1   3.   The method of claim 2 wherein the step of graphically
2   displaying a touch-sensitive pad at said touch-sensitive input
3   area within said display screen, in response to detecting a

4   user's hands positioned at said touch-sensitive area, wherein
5   a user may enter data that may be simultaneously displayed in
6   said display area, further comprises the step of:

7   graphically displaying a touch-sensitive keyboard at said
8   touch-sensitive input area within said display screen, in
9   response to detecting a user's hands positioned at said touch-
10   sensitive area, wherein a user may enter data that may be
11   simultaneously displayed in said display area.

1   4.   The method of claim 3 wherein the step of graphically
2   displaying a touch-sensitive keyboard at said touch-sensitive
3   input area within said display screen, in response to
4   detecting a user's hands positioned at said touch-sensitive
5   area, wherein a user may enter data that may be simultaneously
6   displayed in said display area, further comprises the step of:

7   graphically displaying a transparent touch-sensitive
8   keyboard at said touch-sensitive input area within said
9   display screen, in response to detecting a user's hands
10   positioned at said touch-sensitive area, wherein a user may
11   enter data that may be simultaneously displayed in said
12   display area.

1   5.   The method of claim 4 further comprising the step of
2   displaying data in said display area within said display
3   screen, in response to user data entry at said transparent
4   touch-sensitive keyboard.

1   6.   The method of claim 5 wherein the step of graphically
2   displaying a touch-sensitive keyboard at said touch-sensitive
3   input area within said display screen, in response to
4   detecting a user's hands positioned at said touch-sensitive
5   area, wherein a user may enter data that may be simultaneously
6   displayed in said display area, further comprises the step of:

7   graphically displaying a touch-sensitive ergonomic
8   keyboard at said touch-sensitive input area within said
9   display screen, in response to detecting a user's hands
10   positioned at said touch-sensitive area, wherein a user may
11   enter data that may be simultaneously displayed in said
12   display area.

1   7.   The method of claim 6 further comprising the steps of:

2   analyzing physical characteristics associated with said
3   user while said user is entering a particular sequence of data
4   utilizing said touch-sensitive keyboard; and

5   in response to analyzing said physical characteristics,
6   configuring said touch-sensitive keyboard such that the
7   sensitivity of said touch-sensitive keyboard may be raised or
8   lowered according to said physical characteristics associated
9   with said user.

1   8.   A system in a portable computer having a display screen
2   for increasing portable computer compactness, said system
3   comprising:

4   means for displaying data within said display screen; and

5   means for partitioning said display screen into a touch-
6   sensitive input area and a display area, wherein data input at
7   said touch-sensitive input area may be simultaneously
8   displayed in said display area, in response to a particular
9   user input;

10   means for detecting if a user's hands are positioned at
11   said touch-sensitive input area; and

12   means for graphically displaying a touch-sensitive pad at
13   said touch-sensitive input area within said display screen, in
14   response to detecting a user's hands positioned at said touch-
15   sensitive area, wherein a user may enter data that may be
16   simultaneously displayed in said display area.

1   9.   The system of claim 8 further comprising:

2   means for detecting if said user's hands are no longer
3   positioned at said touch-sensitive input area; and

4   means for concealing said touch-sensitive pad from view,
5   in response to detecting if said user's hands are no longer
6   positioned at said touch-sensitive input area.

1   10.   The system of claim 9 wherein said means for graphically
2   displaying a touch-sensitive pad at said touch-sensitive input
3   area within said display screen, in response to detecting a
4   user's hands positioned at said touch-sensitive area, wherein

5   a user may enter data that may be simultaneously displayed in
6   said display area, further comprises:

7   means for graphically displaying a touch-sensitive
8   keyboard at said touch-sensitive input area within said
9   display screen, in response to detecting a user's hands
10 positioned at said touch-sensitive area, wherein a user may
11 enter data that may be simultaneously displayed in said
12 display area.

1   11. The system of claim 10 wherein said means for graphically
2   displaying a touch-sensitive keyboard at said touch-sensitive
3   input area within said display screen, in response to
4   detecting a user's hands positioned at said touch-sensitive
5   area, wherein a user may enter data that may be simultaneously
6   displayed in said display area, further comprises:

7   means for graphically displaying a transparent touch-
8   sensitive keyboard at said touch-sensitive input area within
9   said display screen, in response to detecting a user's hands
10 positioned at said touch-sensitive area, wherein a user may
11 enter data that may be simultaneously displayed in said
12 display area.

1   12. The system of claim 11 further comprising means for
2   displaying data in said display area within said display
3   screen, in response to user data entry at said transparent
4   touch-sensitive keyboard.

1   12. The system of claim 11 wherein said means for graphically
2   displaying a touch-sensitive keyboard at said touch-sensitive
3   input area within said display screen, in response to
4   detecting a user's hands positioned at said touch-sensitive
5   area, wherein a user may enter data that may be simultaneously
6   displayed in said display area, further comprises:

7   means for graphically displaying a touch-sensitive

8   ergonomic keyboard at said touch-sensitive input area within

9   said display screen, in response to detecting a user's hands

10   positioned at said touch-sensitive area, wherein a user may

11   enter data that may be simultaneously displayed in said

12   display area.

1   13.   The system of claim 12 further comprising:

2   means for analyzing physical characteristics associated

3   with said user while said user is entering a particular

4   sequence of data utilizing said touch-sensitive keyboard; and

5   means for configuring said touch-sensitive keyboard such

6   that the sensitivity of said touch-sensitive keyboard may be

7   raised or lowered according to said physical characteristics

8   associated with said user, in response to analyzing said

9   physical characteristics.

1 14. A program product residing in computer memory in a
2 portable computer having a display screen for increasing
3 portable computer compactness, said program product
4 comprising:

5   instruction means residing in a computer memory for
6 displaying data within said display screen; and

7   instruction means residing in a computer memory for
8 partitioning said display screen into a touch-sensitive input
9 area and a display area, wherein data input at said touch-
10 sensitive input area may be simultaneously displayed in said
11 display area, in response to a particular user input;

12   instruction means residing in a computer memory for
13 detecting if a user's hands are positioned at said touch-
14 sensitive input area; and

15   instruction means residing in a computer memory for
16 graphically displaying a touch-sensitive pad at said touch-
17 sensitive input area within said display screen, in response
18 to detecting a user's hands positioned at said touch-sensitive
19 area, wherein a user may enter data that may be simultaneously
20 displayed in said display area.

1 15. The program product of claim 14 further comprising:

2   instruction means residing in a computer memory for
3 detecting if said user's hands are no longer positioned at
4 said touch-sensitive input area; and

5   instruction means residing in a computer memory for
6 concealing said touch-sensitive pad from view, in response to
7 detecting if said user's hands are no longer positioned at
8 said touch-sensitive input area.

16. The program product of claim 15 wherein said instruction means residing in a computer memory for graphically displaying a touch-sensitive pad at said touch-sensitive input area within said display screen, in response to detecting a user's hands positioned at said touch-sensitive area, wherein a user may enter data that may be simultaneously displayed in said display area, further comprises:

instruction means residing in a computer memory for graphically displaying a touch-sensitive keyboard at said touch-sensitive input area within said display screen, in response to detecting a user's hands positioned at said touch-sensitive area, wherein a user may enter data that may be simultaneously displayed in said display area.

17. The program product of claim 16 wherein said instruction means residing in a computer memory for graphically displaying a touch-sensitive keyboard at said touch-sensitive input area within said display screen, in response to detecting a user's hands positioned at said touch-sensitive area, wherein a user may enter data that may be simultaneously displayed in said display area, further comprises:

instruction means residing in a computer memory for graphically displaying a transparent touch-sensitive keyboard at said touch-sensitive input area within said display screen, in response to detecting a user's hands positioned at said touch-sensitive area, wherein a user may enter data that may be simultaneously displayed in said display area.

18. The program product of claim 17 further comprising instruction means residing in a computer memory for displaying data in said display area within said display screen, in

4 response to user data entry at said transparent touch-
5 sensitive keyboard.

1 19. The program product of claim 18 wherein said instruction
2 means residing in a computer memory for graphically displaying
3 a touch-sensitive keyboard at said touch-sensitive input area
4 within said display screen, in response to detecting a user's
5 hands positioned at said touch-sensitive area, wherein a user
6 may enter data that may be simultaneously displayed in said
7 display area, further comprises:

8   instruction means residing in a computer memory for
9 graphically displaying a touch-sensitive ergonomic keyboard at
10 said touch-sensitive input area within said display screen, in
11 response to detecting a user's hands positioned at said touch-
12 sensitive area, wherein a user may enter data that may be
13 simultaneously displayed in said display area.

1 20. The program product of claim 19 further comprising:

2   instruction means residing in a computer memory for
3 analyzing physical characteristics associated with said user
4 while said user is entering a particular sequence of data
5 utilizing said touch-sensitive keyboard; and

6   means for configuring said touch-sensitive keyboard such
7 that the sensitivity of said touch-sensitive keyboard may be
8 raised or lowered according to said physical characteristics
9 associated with said user, in response to analyzing said
10 physical characteristics.

1 21. The program product of claim 20 wherein each of said
2 instruction means further comprises signal bearing media.

1   22. The program product of claim 21 wherein said signal
2   bearing media further comprises transmission media.

1   21. The program product of claim 21 wherein said signal
2   bearing media further comprises recordable media.

ABSTRACT OF THE DISCLOSURE

METHOD AND SYSTEM FOR TOUCH SCREEN KEYBOARD AND DISPLAY SPACE SHARING

A method and system in a portable computer having a display screen for increasing portable computer compactness. Data is displayed initially within the display screen. The display screen is then partitioned into a touch-sensitive input area and a display area, wherein data input at the touch-sensitive input area may be simultaneously displayed in the display area, in response to a particular user input. A test is performed to detect if a user's hands are positioned at the touch-sensitive input area. A touch-sensitive pad is thereafter graphically displayed at the touch-sensitive input area within the display screen, in response to detecting a user's hands positioned at the touch-sensitive area, wherein a user may enter data that may be simultaneously displayed in the display area. An additional test may then be performed to detect if the user's hands are no longer positioned at the touch-sensitive input area. The touch-sensitive pad is subsequently concealed from view, in response to detecting if the user's hands are no longer positioned at the touch-sensitive input area. The touch-sensitive pad graphically displayed at the touch-sensitive input area within the display screen may be composed of a touch-sensitive keyboard, which may in and of itself be an ergonomic keyboard.
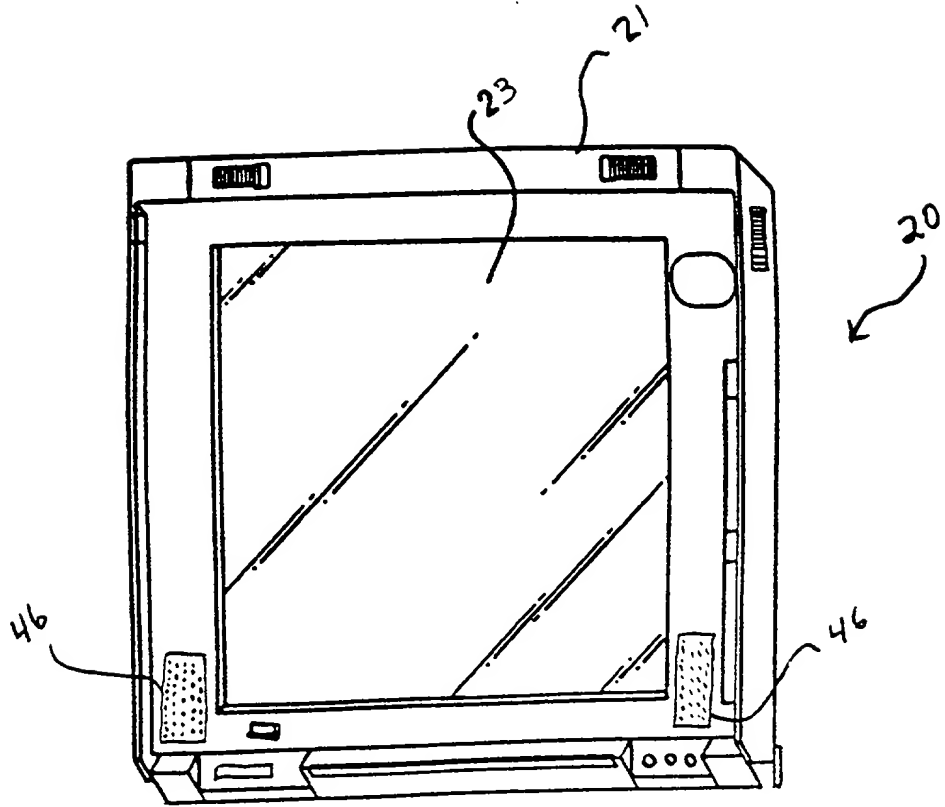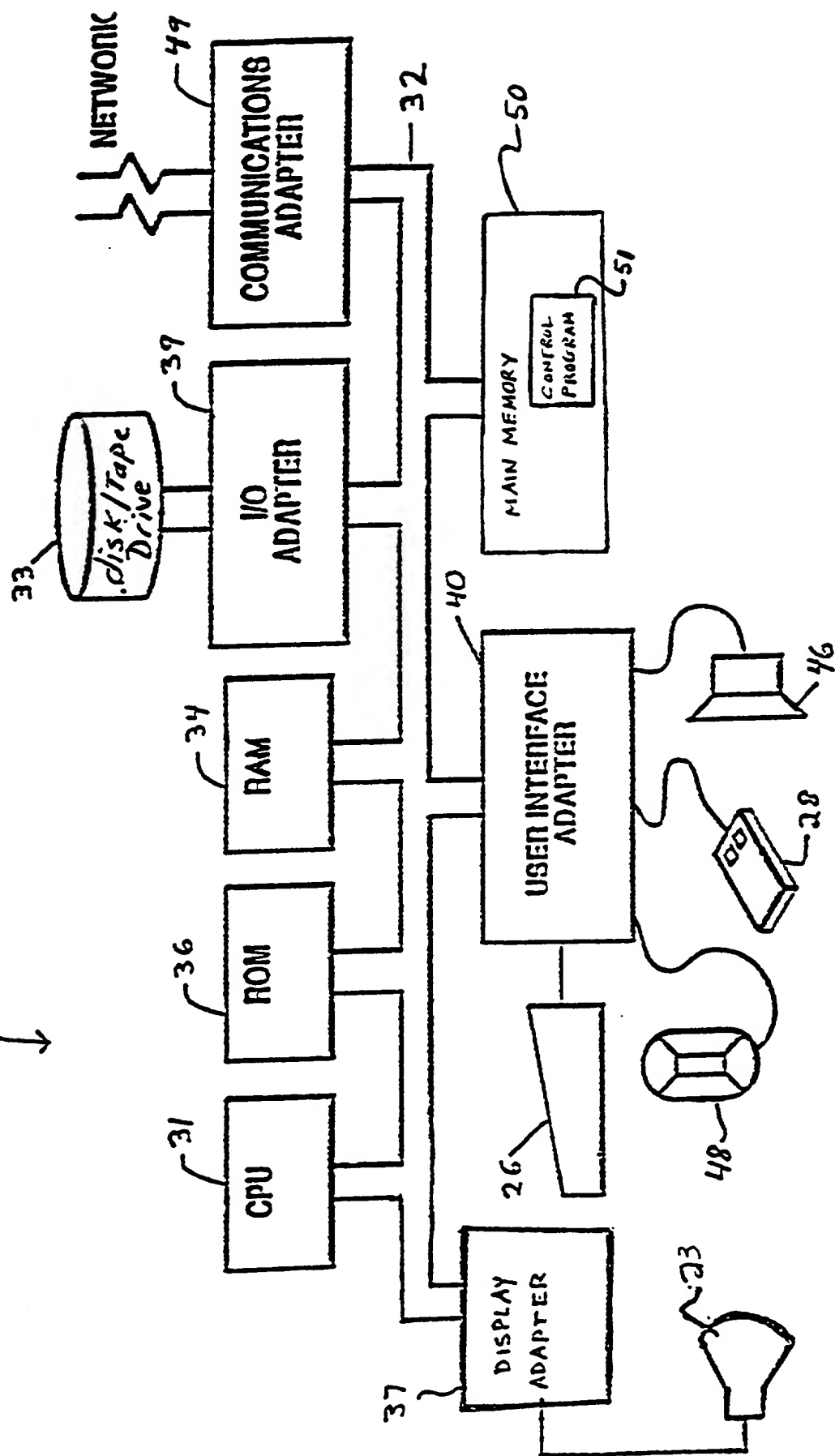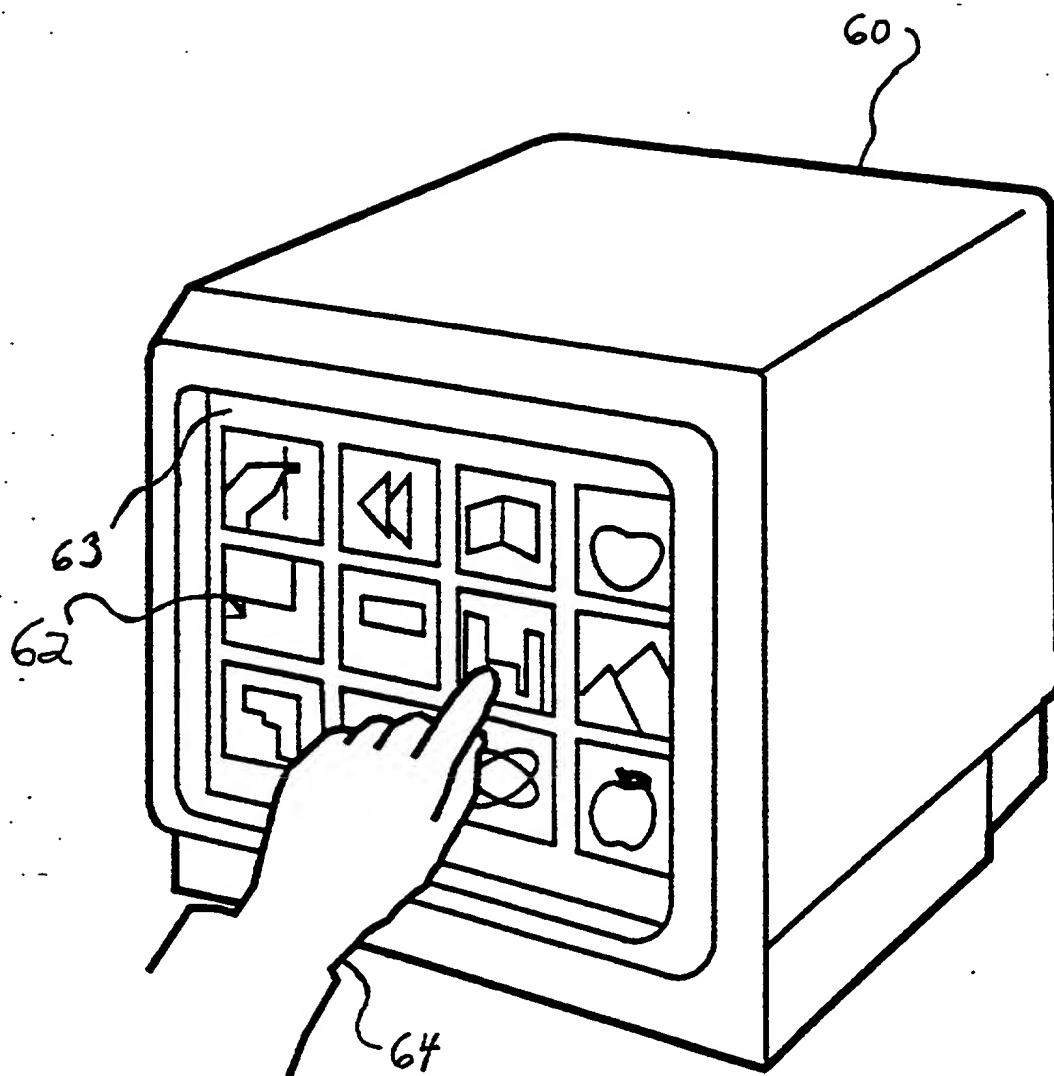
Fig. 1

FIG. 2

Touch Screen

FIG. 3
(prior art)

Dear Sir,
      This letter is in reply to your previous letter. At
this time we are interested in purchasing copiers from
your firm. Our purchasing department will be in contact
with you about this issue in the near future.

M
K
D

FIG. 4

Dear Sir,
      This letter is in reply to your previous letter. At
this time we are interested in purchasing copiers from
your firm. Our purchasing department will be in contact
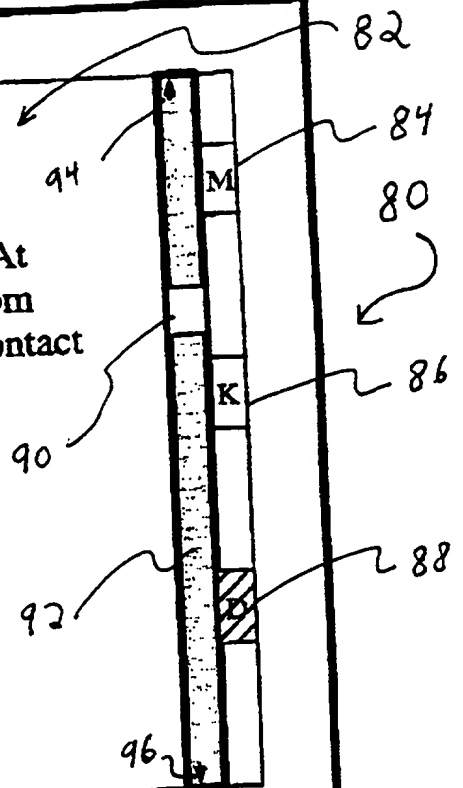with you about this issue in the near future.

M
K
D

FIG. 5

This letter is in reply to your previous letter. At this time we are interested in purchasing copiers from your firm. Our purchasing department will be in contact

Dea...

this time w... ...ers from
your firm. ...e in contact
with you about this issue in the near future.

FIG. 6

This letter is in reply to your previous letter. At this time we are interested in purchasing ten industrial copiers from your firm. Our purchasing department will

Dea...

this tir... ...ial
copiers fror... ...ment will
be in contact with you about this issue in the near future.

FIG. 7

140

START — 142

DESIGNATE TOUCH SCREEN DISPLAY — 144

USER PLACES HANDS AT TOUCH SCREEN DISPLAY — 146

148
USER'S HANDS DETECTED AT TOUCH SCREEN DISPLAY ?

YES

NO

149
IS "D" OR "M" PICKED ?

"M" PICKED

NO

"D" PICKED

MANIPULATE WITH THE MOUSE IN THE MOUSE MODE — 151

153
END MOUSE MODE ?

YES

NO

155
PICK "D" OR "K"

"K" PICKED

"D" PICKED

INITIATE PARTITIONING OF TOUCH SCREEN DISPLAY (INITIATE KEYBOARD MODE) — 150

PARTITION INTO TOUCH SENSITIVE INPUT AREA — 152

DISPLAY TRANSPARENT KEYBOARD — 154

DISPLAY MINI-WINDOW AND PORTION OF DOCUMENT WITHIN MINI-WINDOW — 156
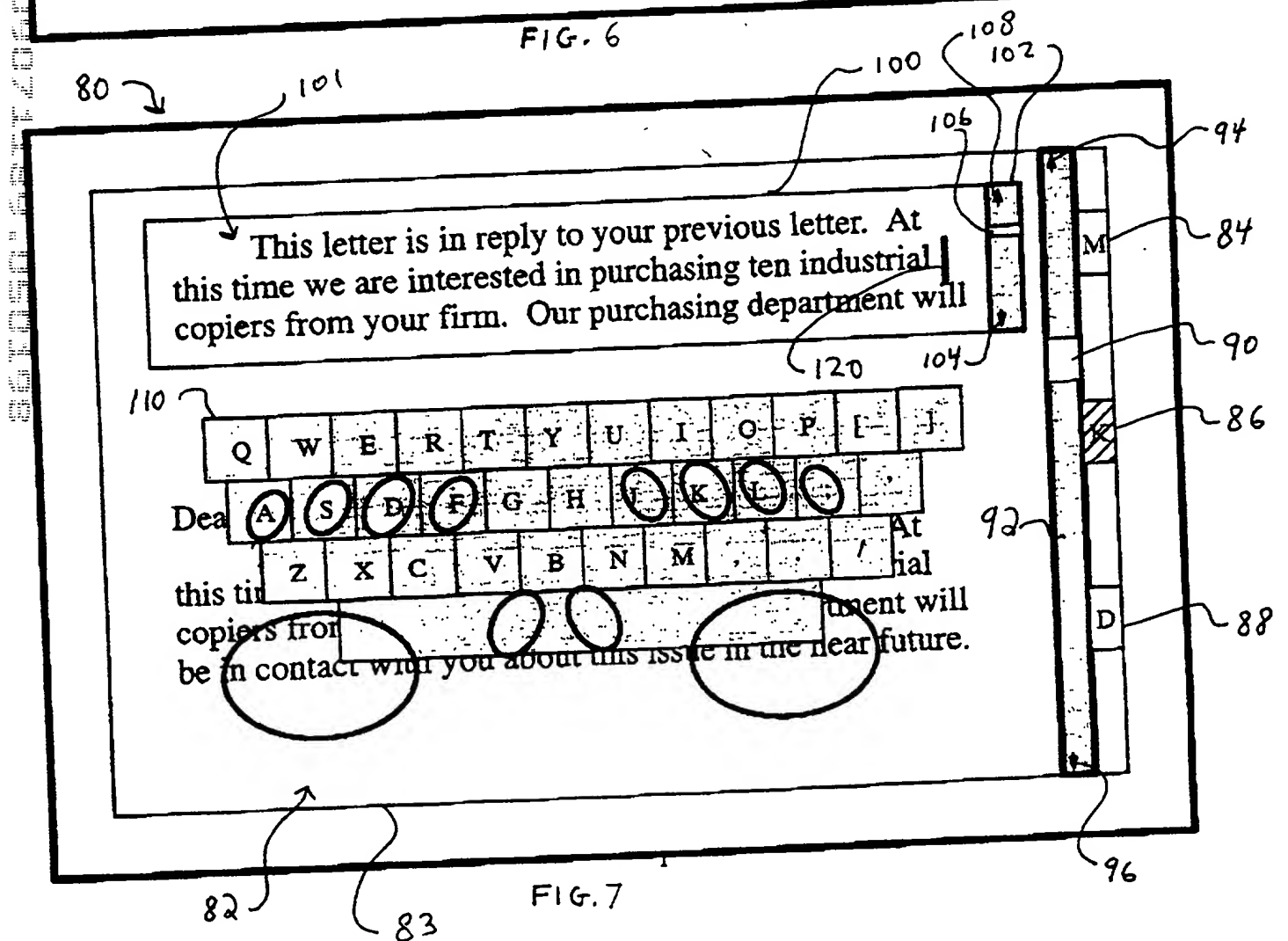
164
END PARTITIONING ?

NO

YES

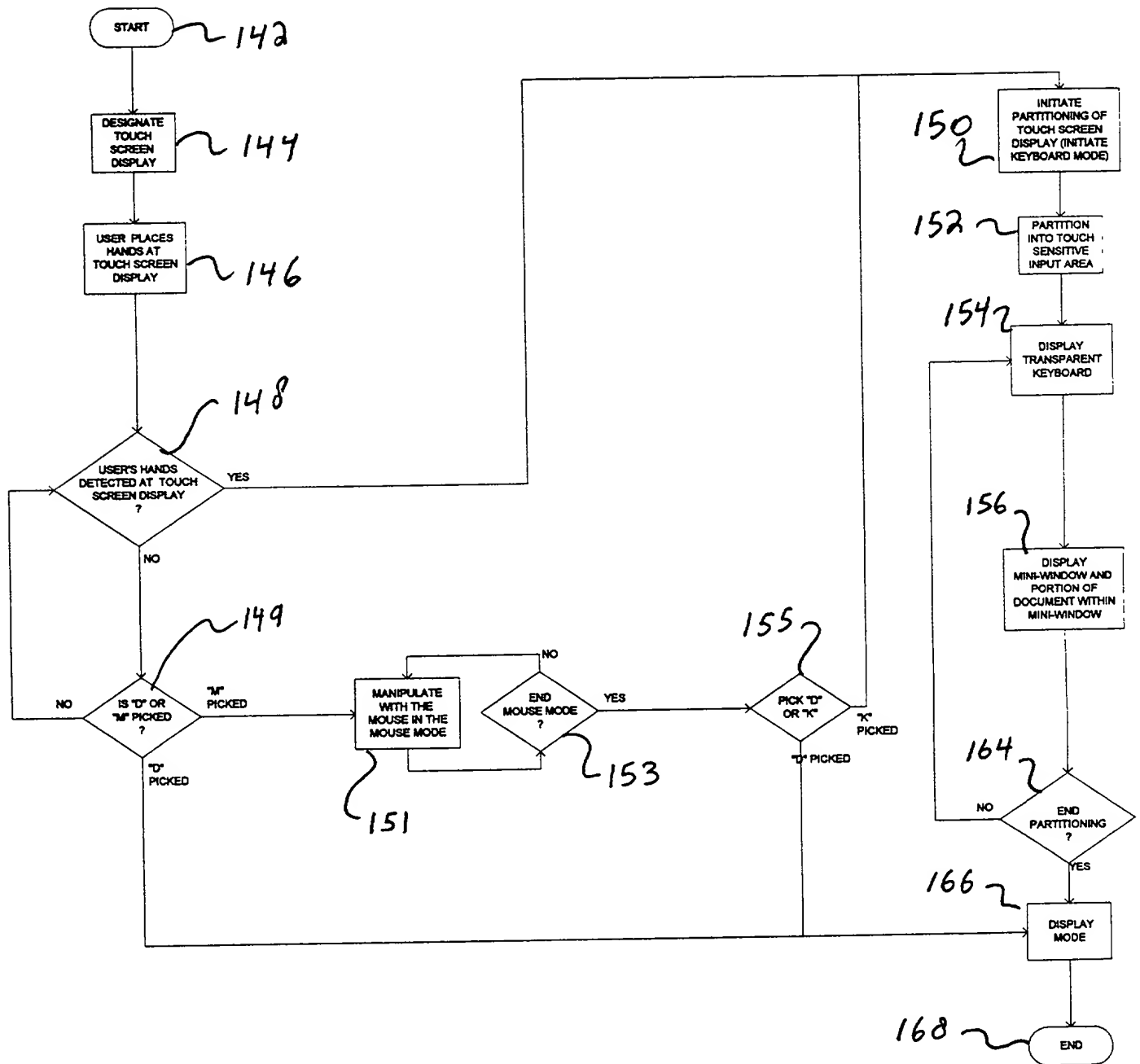DISPLAY MODE — 166

END — 168

FIG. 8

DECLARATION AND POWER OF ATTORNEY FOR

PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name;

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

METHOD AND SYSTEM FOR TOUCH SCREEN KEYBOARD AND DISPLAY SPACE SHARING

the specification of which (check one)

X is attached hereto.

___ was filed on _____
as Application Serial No. _____
and was amended on _____
(if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the patentability of this application in accordance with Title 37, Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

Prior Foreign Application(s):   Priority Claimed

___ Yes___ No

_____ _____ _____
(Number)   (Country)   (Day/Month/Year)

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose information material to the patentability of this application as defined in Title 37, Code of Federal Regulations, §1.56 which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

_____   _____   _____
(Application Serial #)   (Filing Date)   (Status)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorneys and/or agents to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

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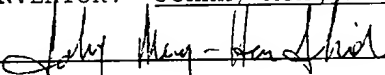INVENTORS SIGNATURE: _(signature)_ DATE: <u>21 april 1998</u>

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